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ACUTE MANAGEMENT CONCEPTS OF THE ACROMIOCLAVICULAR JOINT: A CASE REPORT

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ABSTRACT

Acromioclavicular injuries are quite common and approaches to early management of those that are described as a Type III are controversial. The Rockwood Type III classification implies complete disruption of the acromioclavicular and coracoclavicular ligaments, resulting in inferior positioning of the scapula and, thus, the glenohumeral complex while the clavicle appears more superiorly prominent. Clinical management can include surgical or conservative techniques. This case report outlines the decision making process related to this type of injury, as applied in the diagnosis and management of 61 year-old recreational athlete.

Level of Evidence: 5 (Single Case report)

Key words: Acromioclavicular injury, functional outcomes, shoulder separation, Type III management

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INTRODUCTION

The acromioclavicular (AC) joint is a diarthroidial joint, which includes a fibrocartilaginous disc linking the distal lateral end of the clavicle to the medial edge of the acromion process. There is significant variation of the joint articular size, shape, orientation, and mobility. The composition of the articular cartilage changes during the second decade of life resulting in a more fibrocartilaginous matrix. Likewise, the intra-articular fibrocartilaginous disc degenerates during aging and is no longer a functional structure by age 40.[1] The ligamentous structures that control the joint are the acromioclavicular ligament (primarily controlling anterior/posterior motion) and the coracoclavicular ligaments, comprised of the conoid and trapezoid ligaments (primarily maintaining the vertical position/spacing of the clavicle to the coracoids) (Figure 1). Discussion of disruption of the controlling ligaments dates back to the writings of Hippocrates where he proposed that no significant "impairment" results from these injuries.[2] In many ways, little has changed in the ensuing 2400 years. There are now several well-conducted studies that demonstrate equality of outcome in most subjects when comparing "benign neglect" to nearly all techniques of immobilization or surgical interventions.[3-6]

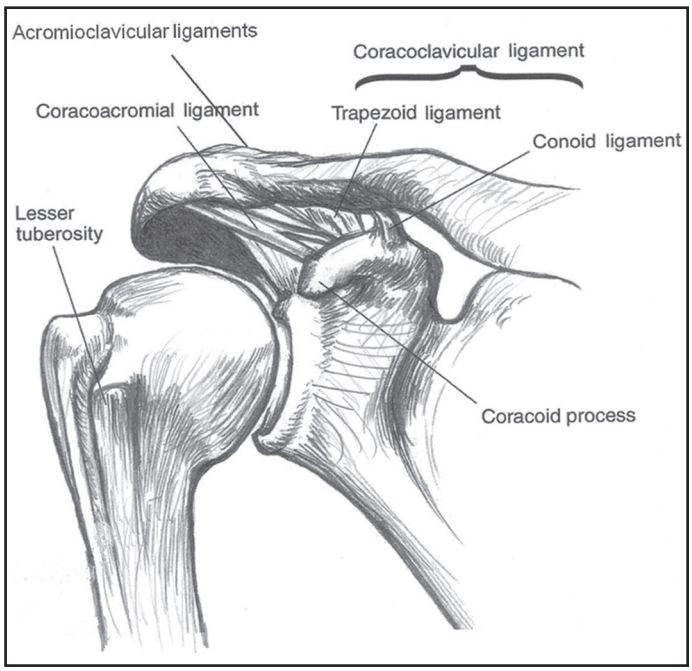

Figure 1. *Bony and ligamentous anatomy of the acromioclavicular joint.*

Rockwood provides a classic chapter on these injuries in The Shoulder.[7] As initially published in 1990, Rockwood suggested a primary classification scheme that delineates severity of injury in relation to specific structure. Type I injury is a partial tearing of the acromioclavicular ligament but with the joint remaining intact. Type II injury is a complete disruption of the acromioclavicular ligament while the coracoclavicular ligaments are not completely disrupted. Type III injury results in greater movement of the described segments (a dislocation) as the acromioclavicular and coracoclavicular ligaments are both completely disrupted and a visible alteration of the shoulder complex results. This greater anatomical disruption results in the "separation" of the clavicle from the coracoid and the clavicle appears superiorly positioned with significant increase in clavicle motion in all planes. Rockwood then further delineated special variations of the Type III as IV, V, and VI where the clavicle is captured by other soft tissues. He outlined recommended treatment based on classification. The focus of this case report is on the management of classic Type III injury.

CLINICAL PRESENTATION

A right hand dominant 61 year-old male faculty member was playing doubles tennis. During play, he was moving to his right in an attempt to extend for a forehand when his shoes caught an edge causing him to fall to the court surface. His right shoulder impacted the surface as he attempted to roll but sustained significant impact prior to completing the roll. Although he played two additional points, he was unable to elevate the shoulder in order to perform a serving motion. The subject had sustained a second-degree acromioclavicular injury four decades prior. Subsequent to the reinjury sustained during tennis, he was able to palpate the freely positioned clavicle, which exhibited easy ballottement, consistent with a Grade III injury, and not a IV, V or VI. As the shoulder was exquisitely painful, ice was applied throughout the night and the subject attempted to sleep in a recliner with the arm supported via pillow propping. The next morning he went to an orthopaedic walk-in clinic in order to have a radiographic assessment to rule out possible fracture. Initially, he was using a typical sling which was readily available, in order to minimize discomfort that was present in

Figure 2. *Presentation of patient in basic sling.*

Figure 3. *Unsupported right shoulder while standing. Note the apparent superior positioning of the distal clavicle.*

the standing position (Figure 2). His presentation was classic for an AC joint injury, with obvious loss of normal contour and significant descent of the glenohumeral complex making the clavicle appear significantly elevated (Figure 3).

New residents and fellows staffed the orthopaedic clinic that the subject utilized for radiographic studies. The immediate discussion offered by the resident there was to utilize magnetic resonance imaging (MRI) to better delineate the soft tissue involvement. The subject (a physical therapist with 30+ years of experience) questioned how this delineation might impact the actual management. The resident physician stated that it would determine if surgery would be performed. The subject then asked why surgery would be performed for this diagnosis if the plain radiographs did not show a fracture and that the free ballottement of the clavicle obviously indicated a Rockwood Grade III injury. After consultation with

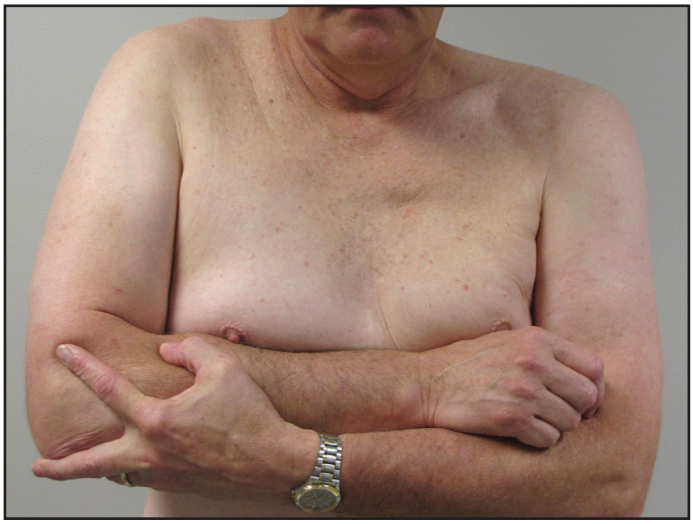

Figure 4. *Supported right shoulder while standing. Note reduction of distal clavicle prominence as compared to the presentation in Figure 3.*

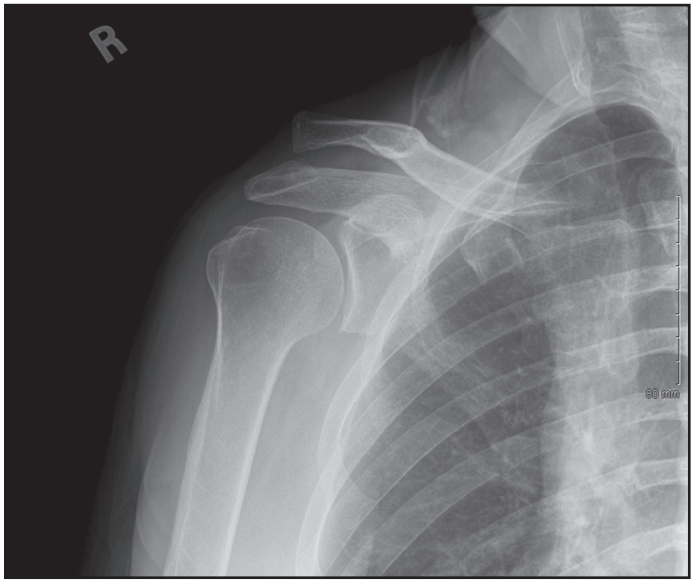

Figure 5. *Antero-posterior view radiograph of the subject's right shoulder. Disruption of the acromioclavicular joint is the obvious finding.*

the attending physician, a standard radiographic series was obtained. The radiographs are presented as Figures 5, 6, and 7.

At this point, the attending physician agreed that there was no need to do a weighted view to enable comparison to the left as he was relatively certain that the injury was well described as a Rockwood Grade III. A relatively short discussion ensued regarding management options. This discussion included the

Figure 6. *Axillary view radiograph of the subject's right shoulder, used to examine the positional relationship of the humeral head and glenoid fossa, which was intact in this case.*

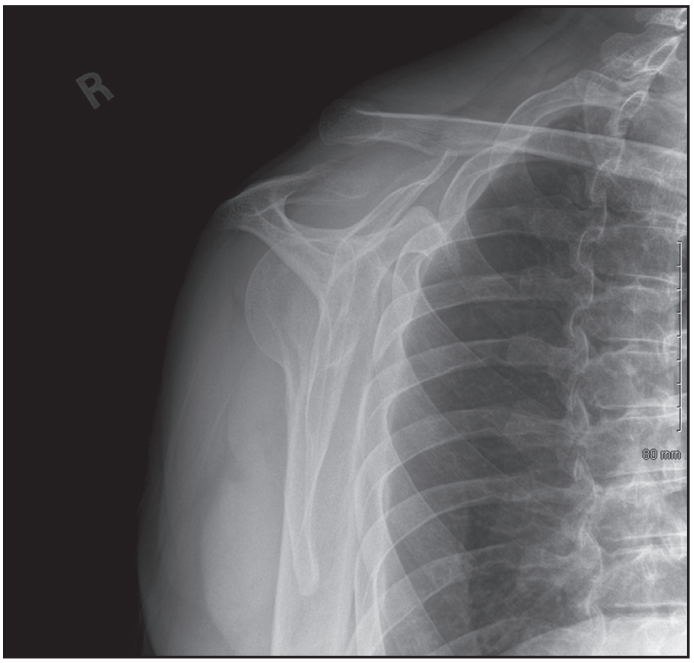

Figure 7. *This modified lateral view radiograph was completed because of the subject's intolerance (due to pain) of alternate positioning requested by the radiological technician.*

newest surgical options being designed to truly reconstruct the coracoclavicular ligaments in as anatomically correct fashion as possible. The following is a synopsis of the literature related to surgical approaches to the Type III acromioclavicular separation.

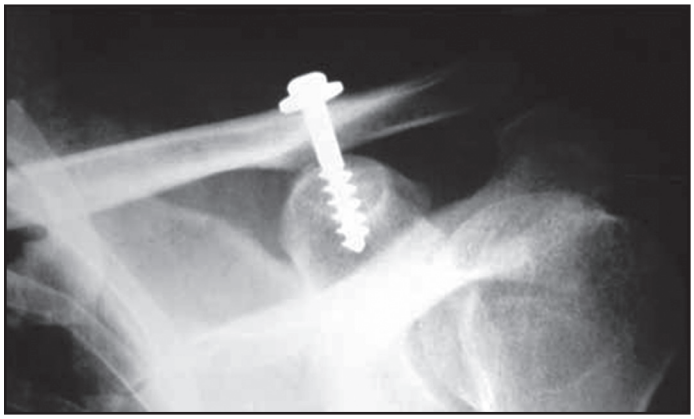

Figure 8. *Example of a Bosworth screw stabilizing the clavicle-coracoid distance (not in the subject of this case report).*

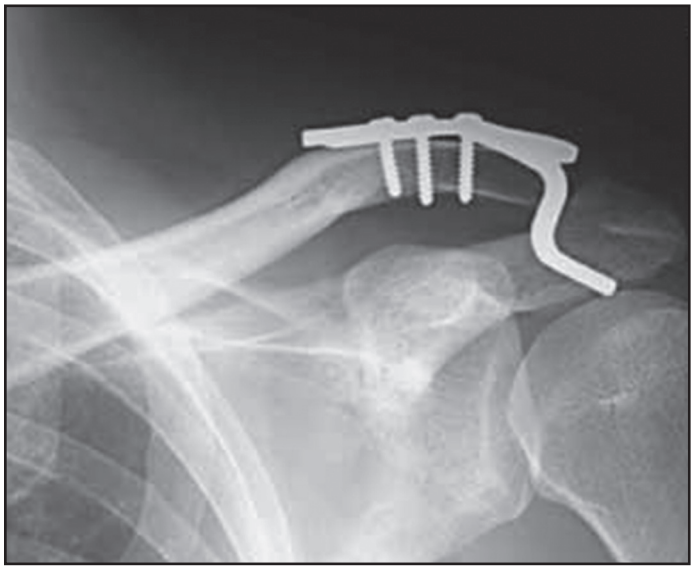

Figure 9. *Example of Hook-plate stabilization (not in the subject of this case report).*

Early approaches were designed to hold the clavicle in proper alignment with the acromion using screws, wires, or pins to provide fixation. Because of problems with wires breaking and migrating, surgeons moved to Steinmann pins which may still break and migrate, thus, being problematic.[7] Because of these complications seen with wires and pins, surgeons changed to utilization of screws of many varieties to stabilize the clavicle in a temporary fashion. The use of screw fixation was later advanced to clavicular–coracoid placement using a large headed lag screw designed by Bosworth (Figure 8).[8] Other surgeons used a distal hooked-plate to stabilize the joint proper (Figure 9).[9] Typically, the screw or plate was inserted to provide temporary fixation and removed at a later date.

Surgeons later progressed to loops of material (including wire and Dacron®) around the clavicle and coracoid in order to create a restraint to displacement.[10,11] Unfortunately, using looped materials led to erosion into the bony structures where they resided, resulting from the normal rotational clavicular movements that still occurred. Difficulties encountered with looped materials pushed surgeons to minimize the use of looped materials and design a technique that did not create the aforementioned complications. In 1972, Weaver and Dunn published their procedure which included distal clavicle resection and transferring the acromial insertion of the coracoacromial ligament to the distal clavicle.[12] In the more recent past, focus has shifted to surgery designed to restore anatomic normalcy to the greatest extent possible. The anatomy related to reconstruction was defined well by Rios et al[13] and Salzmann et al.[14] Likewise, the surgical considerations related to anatomy were defined by Coale et al,[15] while Beitzel et al[16] examined the biomechanics of the newest repair techniques. This has led to the use of an endobutton placed in the clavicle in order to better duplicate the desired insertions of the conoid and/or trapezoid ligaments.[17] Today, if surgical repair or reconstruction is performed, surgeons attempt to duplicate anatomy and enable normal relationships to be recreated.

Interestingly, during the past 20 years numerous studies have been completed which examined the outcomes after these surgeries when compared to conservative care. An early report by Taft et al[6] in 1987 showed that in 127 subjects (52 surgical and 75 conservative) with an approximate 10-year follow-up period, that the "clinical (subjective and objective) ratings were equal in the two groups." In 1989, Bannister et al[3] published a randomized control trial of the management of acute acromioclavicular dislocation. Sixty patients were randomly assigned to receive screw fixation or sling immobilization (27 and 33, respectively). Results were equal between groups four years post-operatively. Further, the surgeons reported that non-operative treatment was superior in the early timeframes. Consistent with these early reports, Schlegel et al[5] provided the natural history of untreated patients with third degree acromioclavicular injury. The average return to work was nine days, objective findings were "surprisingly good considering that no formal treatment was given for this injury" with only a decrease in the strength of the bench press demonstrable, and concluded "that a majority of patients will do well without any formal treatment."[5, p. 702] Smith et al concluded in their recent meta-analysis: "based on the current evidence base, operative management of grade III acromioclavicular dislocations results in better cosmetic outcome ($p < 0.0001$) but a greater duration of sick leave ($p < 0.001$) compared to non-operative management. There was no difference between the two interventions in terms of strength, pain and throwing ability ($p > 0.05$)."[18, p. 26] Kim et al[3] outlined the recommended imaging studies to be performed during assessment of these injuries and reiterate that plain film imaging is the expected and most appropriate starting point.

Figure 10. *Enhanced sling support and stabilization with alternate sling.*

CASE MANAGEMENT

As the patient was a 61 year-old physical therapy faculty member and recreational athlete, with a remote history of a grade II right acromioclavicular joint injury, the discussion of surgical intervention was questioned. Although significant separation was evident (Figures 3 and 5), significant arthritic change was already present at the acromioclavicular joint. The literature does not support early repair being any better than later reconstruction, if it were determined that the resultant instability was problematic and, thus, requiring surgical fixation long-term. The patient was provided a sling that was supportive and provided enhanced fixation of the forearm to the trunk (Figure 10) and was offered analgesic medications.

Figure 11. *Obvious ecchymosis to the area overlying the coracoid process, 1 week post injury.*

The subject was urged to wear the sling as much as possible but could remove it to shower and it was recommended that he support the arm when out of the sling for comfort (as shown in Figure 4). The initial estimate was that two weeks of sling use would be required and that the subject would need to experiment to determine the best sleeping positions. He was to apply ice as often as possible with the recommendation being 20 minute treatments. If after a few weeks he was not happy, he was to contact the surgeon for a follow-up discussion. Otherwise, he was to determine his rehabilitation course. For clinicians not familiar with recommended rehabilitative approaches to the treatment of all grades of acromioclavicular injuries, an excellent resource has been compiled by Reid et al.[19]

Physical therapy friends offered multiple interventions. The most common recommendation was to tape the clavicle downward. However, since the coracoclavicular ligaments were completely torn in this Grade III presentation, the use of tape would be palliative at best and in the authors' experience – not well tolerated, as it is frequently irritating to the skin. In this particular circumstance this intervention may have been less than useful as the AC joint already demonstrated arthritic changes and might not tolerate the additional external pressure. It was also very interesting that the clavicle could be reduced to the acromion via humeral compression and inferior pressure to the clavicle – but the reduction was lost as soon as either was removed. Some older physical therapists suggested the use of the vest/humerus sling, commonly known as the Kenny Howard Sling. This device attempted to keep the humerus pulled up and the clavicle pushed downward. Of course, a problem occurs when the subject must bathe, during which, removal of this type or any type of sling results in loss of joint approximation. History has shown that patients had very poor compliance in using the Kenny Howard Sling and the treatment was, in reality, benign neglect.

The subject found that sleeping in a recliner offered the most flexibility in pillow propping and maintenance of a comfortable, supported position. He also found that it was easier to initiate hip flexion/standing postures from the recliner than a supine bed position. The subject is right hand dominant, and the functional alteration of typing with the left greatly impacted his work comfort. On the third day post-injury, he found a propping position that enabled use of the right hand for typing but soon realized that he should not lean onto the supported right forearm as clavicle would impact the acromion with resultant discomfort. The sling was used for one week and careful movements of the humerus below 90 degrees were begun. Figure 11 shows the presentation at one week post injury. At this point, the subject began sleeping in a bed and wore a more encompassing sling or a pillow was placed to support the forearm in relation to the trunk. He was performing scapular control motions on an hourly basis to not allow a decrease in proximal muscular control.

During the next three weeks, a slow progression of activities ensued. Toileting was one self-care activity that remained difficult as extension and internal rotation combined to give an impingement like response. Side arm sleeping (both onto the involved side and also prone with the involved shoulder elevated to enable the forearm to be under the pillow) was accomplished during the third week along with full range of motion. However, tenderness in full elevation as well as the combined movements of internal rotation and extension remained. He was able to work as a volunteer framer for a Habitat for Humanity home starting in the third week and could do all tasks below 90 degrees, but was cautious to limit overhead nailing or lifting of heavy objects. He was able to swing a golf club without discomfort during the fifth week. Although a very obvious "step-off" deformity remains, only minor popping or irritation

seems to persist. The shoulder complex does ache periodically, particularly after several hours of typing or several hours of heavier upper extremity work as a framer have been completed.

CONCLUSIONS

Although the treatment of Rockwood Type III may be somewhat controversial, the predominant literature is supportive of non-operative management. If the patient is not satisfied with their function and/or cosmesis after 3–6 months, surgical reconstruction can be performed with more recent approaches focused on anatomic restoration. In this patient, early immobilization for comfort, early functional activities limited to below 90 degrees followed by functional patterns in the third week accomplished a rapid return to full range of motion and activity. Plain film imaging is all that may be required in the majority of these injuries to delineate grade or type of injury and guide treatment.

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